

4.3 The Sine Law in Acute Triangles

The Sine Law is True in any acute triangle:

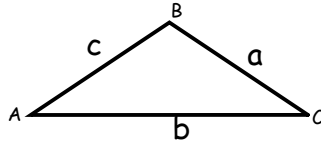
for finding sides:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

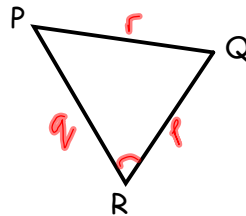
for finding angles:

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

Pay attention at the labeling of a triangle:



The vertices are labeled in capitals, and each side corresponds to the opposite vertex, labeled in lower case letter.



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Ex 1:

Given $\triangle ABC$ where: $c=4.7$
 $a=5.2$
 $\angle A=32^\circ$

Find: $\angle C$

Solution:

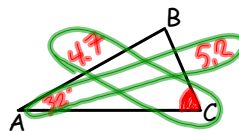
$$\frac{\sin C}{c} = \frac{\sin A}{a}$$

$$\frac{\sin C}{4.7} = \frac{\sin 32^\circ}{5.2}$$

$$\sin C = \frac{4.7 \sin 32^\circ}{5.2}$$

$$\sin^{-1}(\sin C) = \sin^{-1}\left(\frac{4.7 \sin 32^\circ}{5.2}\right)$$

$$C = 29^\circ$$



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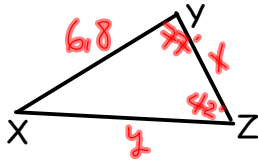
Ex 2:

In a triangle XYZ the following is given:

$$z = 6.8 \text{ cm}, \angle Z = 42^\circ, \angle Y = 77^\circ$$

Solve triangle XYZ.

(To solve a triangle means to find ALL unknown sides and angles)



$$y = 9.9$$

$$\angle X = 61^\circ$$

$$x =$$

$$\frac{y}{\sin 77^\circ} = \frac{6.8}{\sin 42^\circ}$$

$$y = \frac{6.8 \sin 77^\circ}{\sin 42^\circ}$$

$$y = 9.9$$

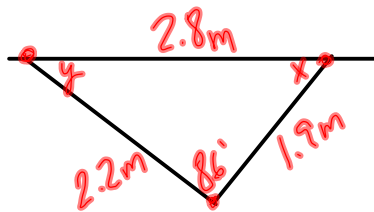
$$\frac{x}{\sin 61^\circ} = \frac{6.8}{\sin 42^\circ}$$

$$x = 8.9$$

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Ex 3:

Toby uses chains and a winch to lift engines at his garage. Two hooks in the ceiling are 2.8 m apart. Each hook has a chain hanging from it. The chains are of 1.9 m and 2.2 m. When the ends of the chains are attached, they form an angle of 86° . In this configuration, what acute angle to the nearest degree does each chain make with the ceiling?



$$\frac{\sin X}{2.2} = \frac{\sin 86^\circ}{2.8}$$

$$\sin X = \frac{2.2 \sin 86^\circ}{2.8}$$

$$X = \sin^{-1} \left(\frac{2.2 \sin 86^\circ}{2.8} \right)$$

$$X = 52^\circ$$

$$\angle y = 180^\circ - 52^\circ - 86^\circ$$

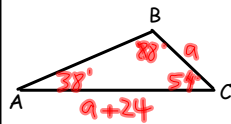
$$\angle y = 42^\circ$$

\therefore the angles are 42° & 52°

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Ex 4:

Two angles in a triangle measure 54° and 38° . The longest side of the triangle is 24 cm longer than the shortest side. Calculate the shortest and longest sides.



Hint: The longest side is across from the largest angle and

The shortest side is across from the smallest angle

88 is the longest side

$$\frac{a+24}{\sin 88^\circ} = \frac{a}{\sin 38^\circ}$$

$$(a+24)(\sin 38^\circ) = a(\sin 88^\circ)$$

$$a \sin 38^\circ + 24 \sin 38^\circ = a \sin 88^\circ$$

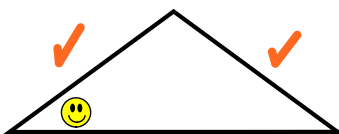
$$24 \sin 38^\circ = a \sin 88^\circ - a \sin 38^\circ$$

$$\frac{24 \sin 38^\circ}{\sin 88^\circ - \sin 38^\circ} = \frac{a(\sin 88^\circ - \sin 38^\circ)}{\sin 88^\circ - \sin 38^\circ}$$

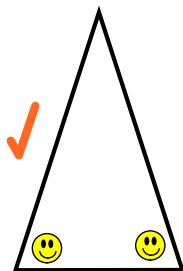
$$a = 38.5$$

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Use the Sine Law when you have an oblique (non right) triangle that has:



- two sides and the angle across from one known side



- two angles and any side

(note: you can find the third angle by subtracting from 180° if you need it)



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Hmwk p 288 # 3, 5, 6a, 7, 8c, 9c, 10



Oct 29-8:52 AM